Public sector wage premium in Poland: can it be explained by structural differences in employment?

Gabriela Grotkowska[*], Leszek Wincenciak[*]

Abstract

The public sector is commonly thought to offer relatively low wages, but neither statistics nor research for different countries justifies this belief. In general, the observed regularity is that the average wage in the public sector exceeds the average wage in the private one. The difference is sometimes quite substantial. The comparison of raw average wages suggesting higher wages for public sector would however be misleading. To a large extent, this premium can be attributed to the differences in the structure of employment in both sectors. The public sector employment is biased towards higher level of education and longer job tenures, which on the grounds of human capital theory explains the observed higher average wages in the public sector. The aim of this article is to find to what extent the observed difference in wages is a result of differentiated structure of employment. We use LFS data for Poland and a Mincerean wage regression with Heckman correction supplemented by a quantile regression to show that, after controlling for structural differences in employment, the public sector wage premium in Poland is negative.

Keywords: wage, premium, public sector, private sector, Poland.
JEL Codes: J31, J45.

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[*] Faculty of Economic Sciences, University of Warsaw.

Introduction

The transformation of Polish economy over the last 25 years resulted in privatization of economic activity. Its most important impact was rapid increase in employment in the private sector. Nevertheless, it is the public sector that still remains the biggest employer in Poland. In a third quarter of 2013 the public sector employed 3 925 000 people which accounts for 25,3% of total employment in Poland[1].

The public sector itself underwent deep restructuring after 1989, which affected both the supply side and the demand side of the labour market in this sector. On the labour demand side, the changes were related to the structure of the labour demand by economic activity, by occupations and forms of employment. Labour supply side exhibited changes in the level of education of public sector employees as well as their fields of education.

The importance of the public sector for the functioning of the labour market goes beyond its borders. It influences also the situation in the private sector. One of the main channels of this impact is the mechanism of wage setting. Both for institutional (bargaining and wage setting scheme), and strictly economic reasons (mechanism of arbitrage) the level and structure of wages in the public sector impacts wages in the private one, and thus affects the overall competitiveness of the economy, inflation and other macroeconomic variables.

At the same time, the functioning of the public sector, in particular the ratio of the productivity to the cost of employment affects the efficiency of the whole economy, growth rate and social welfare. Public sector wages are also important for public finances, as they are in fact one of the main sources of the expenditure of the central and local government budgets. This mechanism makes the wages in the public sector an important factor affecting an overall economic performance and an interesting area of research in economics.

Although the public sector is commonly seen as offering relatively low wages (offset to some extent by other employment benefits), statistics and research for different countries show that this opinion is not justified. In general, the observed regularity is that the average wage in the public sector exceeds the average wage in the private one. According to CSO publication „Employment, wages and salaries in national economy first quarter 2014" the average monthly gross wage in Poland in the 1st quarter of 2014 was PLN 3895.31, but it was PLN 4683.93 for the public sector and PLN 3542.15 in the private sector. This difference is quite substantial. The comparison of raw average wages would lead to a misleading conclusion that

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[1] Share of public sector for employees only is even greater and amounts to 32,4% (Central Statistical Office of Poland, 2013). According to LFS data published in May 1992, public sector employed 51% of total employment in Poland. When agriculture is not taken into account, this share amounts to 73% (CSO 2003).

the public sector offers higher wages than the private one. As it seems to a large extent, this premium can be attributed to the differences in the structure of employment in both sectors. For many reasons (of which the most important seems to be the specificity of public services), the public sector employs people with a higher level of education (and often older) than the private sector. The average job tenure is also much longer for public sector employees. Both of these factors on the grounds of human capital theory would justify higher wages in the public sector. The question remains – to what extent the observed difference in wages is a result of differentiated structure of employment?

Empirical studies for various economies indicate that even after controlling for structural differences in employment, the public sector wage premium is still significant and positive, especially for women and less skilled. Its scale is however differentiated, changes over time and depends on institutional regulations of given labour market. For a comprehensive review of these issues see Bender (1998) and Borland (1999).

The main aim of this article is to calculate the magnitude of the public wage premium adjusted for structural differences in employment in Poland two decades after initiating the economic and political transformation.

The article consists of three parts. The first part is devoted to the theoretical background of wage differentiation by sectors. The second part documents the evolution of empirical strategies and methodologies in estimating the public sector wage premium, both for advanced economies and transformation countries in Central and Eastern Europe, and Poland in particular. The third part presents the empirical study of public sector wage premium in Poland. It consists of the stylized facts portraying the evolution of relative wages and changes in the structure of employment. Our own study is presented in two methodological approaches. The first one utilizes the Mincerean wage regression with Heckman selection (Heckman, 1979; Belman and Heywood, 1996; Bender and Elliott, 1999), while the second one uses quantile regression procedure. Data used in the analysis come from the Labour Force Survey (CSO, 1995-2010). The article ends with conclusions and suggestions for further research.

1. Theoretical background for public-private wage differentiation

Public sector specific features imply that the mechanisms of hiring, firing and wage setting act differently than in the private sector. There are several reasons for observed wage differences between both sectors.

First, public and private sector differ in the aspect of economic activity. In Poland, almost 2/3 of public sector employment is concentrated in three sections: public administration and national defence, social security, education and health. At the same time these three sections make only 23% of total employment in the

whole economy. All of these sections exhibit lower variability of demand for their services and do not face high degree of market competition. It is true that the transformation of Polish economy resulted in partial privatization of health and education sections, yet the public sector still retains its dominant position.

Second, public and private firms differ in their goals. Maximization of profit, stated commonly as a target for private sector companies, is not seen as a primary aim for public sector institutions. They are mostly focused on delivering public goods and services, redistribution of wealth, realization of social and political goals. Some of these aims (like equity) can be achieved through wage policy. As a result, wage structure in public sector is more compressed, which rewards less skilled and puts restrictions on high skilled salaries, especially for managers. The agency theory predicts that the principal-agent problem might be more important for the public sector (see: Eisenhardt, 1989 for a survey of the literature on agency theory). This problem is a result of asymmetry of information between the two parties. The principal (government) might want to generate higher efficiency and appropriate incentives (public sector employees) with higher wages. Better monitoring of the effort might reduce the need to pay more, but in the public sector it is not always clear who the owner is and who should monitor the effects (Bebchuk and Fried, 2004).

Third, public sector is often more unionized than the private one, which strongly affects the wage setting mechanism. There is scarcity of data in this area, but using the information from CBOS study of 2013, the union membership is declared roughly by 10% of the employees in Poland. However, the union membership is declared three times more often in the case of public sector employees[2].

On the other hand, wages in the public sector are subject to more constraints than in the private one. High wages for managerial staff are often socially unacceptable and cause social protests. On some local labour markets, the public sector has a monopsony power, as it remains the only source of demand for higher education (Mueller, 1998), which allows it to dictate the wage levels. Lower wages can be somehow compensated by other employment benefits, like higher job security, more flexible hours of work and others.

It should be also noted that the public sector wages are less related to the business cycle, while private ones seem to be strongly procyclical. This indicates that the public sector relative wage is countercyclical – it increases in times of economic slumps, which would justify potential attractiveness of public sector employment in times of economic crisis. Some economists have also pointed out that the public sector wages are significantly related to electoral cycles (Borjas, 1984).

Lastly, it is worth to take a look at the role of institutions, which regulate wage setting and employment conditions in the public sector (see: Silvestre and Eyraud

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[2] For further information: CBOS (2013).

1995, Elliott et. al 1999 for a review of different wage setting arrangements in a cross country approach). Although in many countries some reforms were implemented to introduce more market economy mechanisms to public sector, it still retains visible differences in the recruitment process, wage setting, collective bargaining and labour unions behaviour. The immanent feature of this system is a high degree of job security, but also strictly regulated rules of promotion and remuneration, related mainly to job tenure, not efficiency. The institutional aspects, although very interesting and important, are not the subject of this article. For further and deeper analysis of this problem we refer to Makepeace and Marcenaro-Gutierrez (2006), and Burgess and Metcalfe (1999).

2. Short literature review of the public sector wage premium studies

Research on the public sector wage premium has a long tradition and has gone through significant methodological evolution. The following short literature review refers to selected studies and shows a variety of methodological approaches with selected results for the individual economies in different institutional contexts.

The earliest studies of the public sector wage premium appeared for the United States (Smith, 1976 and 1977). They revealed higher wages in the public sector, especially higher for women than men. Ehrenberg and Schwarz (1986) and Gregory and Borland (1999) conducted an extensive survey of the vast literature of the early research in this area. Traditionally, researchers focused on the analysis of average wages, mainly using Mincerean wage regressions (Mincer, 1974), where among the control variables a dummy variable for public sector was included. This approach allows for control of other characteristics of employment in both sectors (personal and job characteristics), thus allowing to isolate the pure effect of the public sector. The general conclusion of these studies indicates that this premium is positive and amounts on average to 3-11%, higher for women than for men (Gregory and Borland, 1999).

The first generation of studies, using a linear regression models, did not take into account the differences in the characteristics of the wage distribution in the public and private sectors. Poterba and Rueben (1994) in the study for the United States, using Current Population Survey for 1979-1992, were the first to have taken into account the fact that wages in the private sector are more dispersed than in the public sector. Applying the method of quantile regression they showed that public sector employees enjoy a positive wage premium in the bottom of the wage distribution, but receive a wage penalty in the upper parts of the distribution. Other studies using quantile regression were carried out for Canada (Mueller, 1998), the UK (Disney and Gosling, 1998 and Blackaby et al., 1999), Switzerland (Bonjour, 1999), Zambia (Nielsen and Rosholm, 2001), Germany (Melly, 2004). Luci-

fora and Meurs (2006) used this method in a comparative study of three countries (France, Italy, and the United Kingdom) and have attempted to show the effects of institutional differences for public sector wage premium. They showed that in all three countries, the low-skilled earn higher wages in the public sector than the private one. Inverse relationship is observed for those with higher qualifications, the differences in women are found to be higher than for men.

Another problem that has been addressed in the literature is the issue of non-random sample selection to public sector, which seems to be justified by statistical analysis of the structure of employment in both sectors. This issue is analogous to the classical problem of selection undertaken in the analysis of wages, where we are dealing with non-random selection of the population of wage earners. The studies of the public sector wage premium need to resolve the problem of double sample selection: at the first step – to participate in the labour market, and the second step – to be employed in the public sector. The most commonly used approach here is the standard Heckman (1979) procedure, although the problem to identify the factors that allow for modelling of the selection (variables correlated with the participation in the public sector, but not affecting the level of wage) remains very difficult to solve. Questions also arise whether these two decisions are independent. This problem is most often solved by the method proposed by Tunali (1986). In the case of selection for participation, demographic variables are used (e.g. fact of having children). It is difficult to find variables for selection equation for employment in the public sector. The most commonly (if available at all) used variables here are data concerning the social status such as parents' educational level and their profession (e.g.: Bender 2003, Hartog and Oosterbeek, 1993). An example of a study in which an attempt was made to control for double selection is the study of the public sector wage premium in Scotland (Heitmueller, 2006). In this study, the selection equation for participation uses data on the number of children aged 0-11 years and 12-18 years, while in the selection equation for the public sector employment – information about a person's opinion on the role and activities of trade unions is used.

Another solution to the problem of sample selection is to use a switching regression method. The assumption behind the switching regression model is that wages of the two groups of employees (public and private sector) are possibly determined by two distinct covariates. Additionally, a probit model of selection to either of the groups is estimated using at least one variable which is not included in the wage equation for the model to be identified (Maddala and Nelson, 1975). This approach is applied, among others, by Stelcner, van der Gaag and Wijverberg (1989), Adamchik and Bedi (2000) and Heitmuller (2004). These studies indicate the existence of non-random selection to the public sector. Interesting development of this method was presented in the study by Melly (2005), who used a quantile switching regression with instrumental variables.

A number of studies carried out for the developed economies indicate the existence of a positive public sector wage premium, although its magnitude varies between the studies. In general, it seems that for low wage earners, this premium is positive. On the other hand, people with relatively high salaries earn more in the private sector. Most of the findings indicate that employment in the public sector is generally beneficial for women and people with lower levels of education.

A group of studies, to which we pay special attention to in the context of our empirical study of wage premium in Poland, are the papers examining public sector wage premium in the countries undergoing economic and political transformation. They used different methodological approaches, but a common feature of these studies is that the results are largely inconsistent with the findings for the developed countries in one important aspect (Flanagan (1995) for the Czech Republic, Newell and Socha (1998), Adamchik and Bedi (2000), Newell (2001), Adamchik, Hyclak and King (2003) and Newell and Socha (2007) for Poland, Lehmann and Wadsworth (2000) and Brainerd (2002) for Russia, Hámori (2008) and Laušev (2010) for Hungary). It seems that the initial period of transformation adversely affected the public sector wage premium (the wage gap is estimated to be on average about 20% in favour of the private sector). The absolute value of the wage gap decreased with time to zero and became positive in some countries.

One of the most often cited papers in the literature in this area is done for Polish labour market (Adamchik and Bedi, 2000). It uses individual data from the Labour Force Survey of February 1996. Authors included the effects of selection into employment and controlled for individual characteristics of employees. They found that earnings were significantly higher in the private sector, therefore the public sector wage premium turned to be negative. This effect was particularly strong in the case of people with higher education. For men with 5 years of work experience and a higher level of education the wage premium for the private sector was 18%. For women, this premium was 23%. This study sample was restricted to employees with 40-50 working hours a week. Basing on the results, authors formulated the concern that due to the low attractiveness of the wage levels, the public sector would face serious difficulties to attract and retain qualified employees. In addition, low wages could encourage moonlighting, which might deteriorate the efficiency of the public sector.

Other studies for the Polish labour market were undertaken by Socha. In a study with Weisberg (2002), they used the LFS data for November 1995 and showed that wages in the private sector are higher by approximately 9.8% compared to the public sector after controlling for differences in employment characteristics. Variables associated with human capital showed a greater importance in determining wages in the private sector than in the public one. The study by Newell (2007) demonstrated the existence of a significant and positive wage premium for the private sector in the 1990s, which however, was not confirmed by the data collected

after 2000. The fact that the private sector in Poland offers higher rewards for higher qualifications was also confirmed by Rutkowski (1996, 1997), who showed that each additional year of schooling is associated with the rate of return of 0.8% -0.9% higher in the private sector than in the public one.

3. Evolution of the structure of employment in the public sector in Poland

Review of the literature points out that the average wage in the public sector is heavily affected by its specific structure of employment, significantly different from the structure of employment in the private sector. Therefore, before estimating the size of the public sector wage premium in Poland, we document the current state and evolution of the structure of employment in the public sector[3]. The most important structural change that has taken place on the Polish labour market on the demand side was the restructuring of economic activity (see Figure 1).
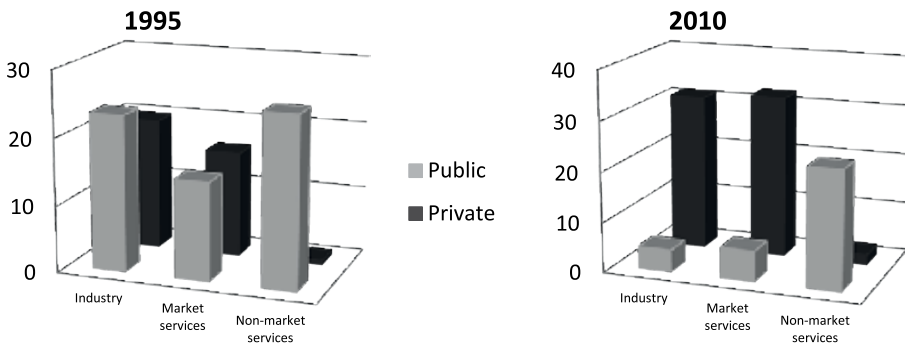

Figure 1. Distribution of employment by economic activity in public and private sectors, 1995 and 2010

Note: all bars sum up to 100.

Source: Own calculations, LFS data.

In this respect, the dominance in employment of the public sector is mostly evident in non-market services. Currently (LFS 2010) up to 68.9% of employees in the public sector are concentrated in three sections (administration, health and education). Employment in the private sector is almost exclusively restricted to in-

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[3] In the following analysis, we use the raw data from the Labour Force Survey 2010 (4 aggregated waves). These are the latest data available to the authors. Although not fully up to date, it is used for consistency with the estimations presented in the next section. Analysis undertaken here relates primarily to structural aspects, which do not undergo rapid changes on annual basis. The calculations presented in this section are authors own calculations based on weighted individual LFS data. Values for 2010 were related to the 1995.

dustry, construction and market services. A comparison of the structure of employment by economic activity in 2010 and 1995 brings interesting conclusions: public sector specialized in non-market services with clear declines of shares in industry (from 36.7% to 13.1%) and market services (from 23.1% to 18.0%). On the other hand, the private sector has experienced less rapid changes, exhibiting primarily a minor increase in the role of market services. Interestingly, the share of non-market services in employment of the private sector grew over the period (particularly in health and education), but the magnitude still remains marginal (3.2%).

    One of the most characteristic features of the public sector in Poland is its feminization. Currently, almost 60% of employees in the public sector are women (LFS, 2010). In the private sector this share is slightly above 40%. Moreover, the structure of employment by sex has changed significantly over the last 15 years – the share of women in public sector employment increased by more than 22% (see Figure 2). This could be due to changes in the structure of economic activity in the public sector (the decline of industrial production and rise of non-market services, which are highly feminized).

■ Share of women in the public sector

■ Share of women in the private sector

— Average wage of the employed in the public sector (right axis)

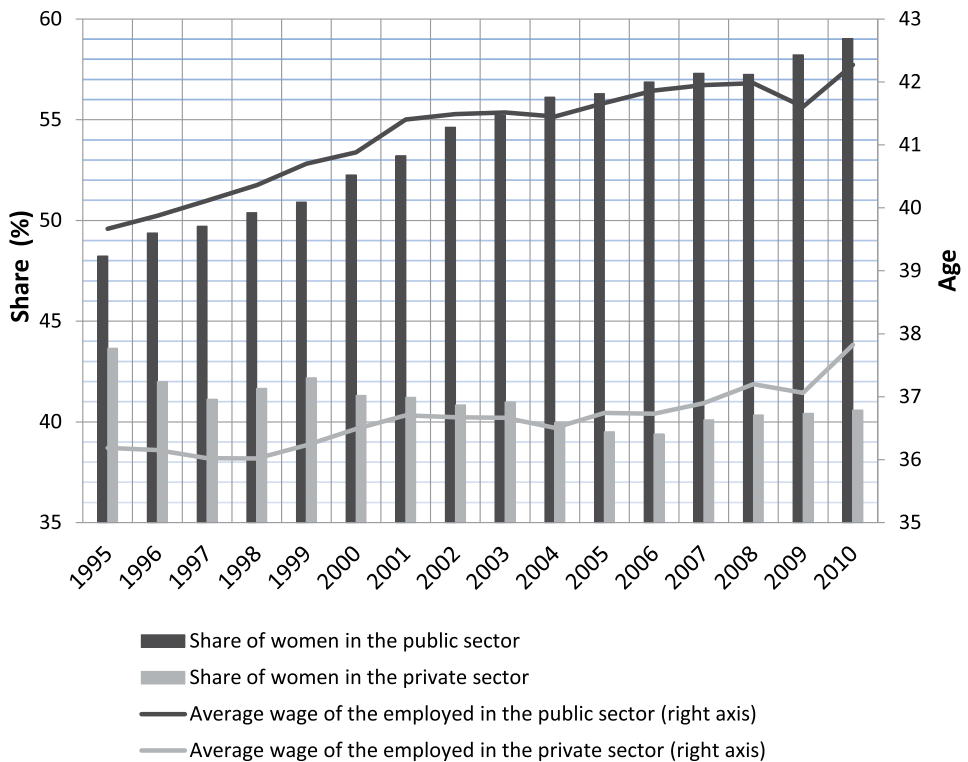— Average wage of the employed in the private sector (right axis)

Figure 2. Change in the structure of employment in public and private sectors, 1995-2010: basic demographic characteristics

Source: Own calculations, LFS data.

The public sector employs on average, older workers: a much higher share of employment in this sector (compared to the private sector) is attributed to people of immobile age (45-59/54 years) and the age of formal retirement (60/65 years or more), although the share of the latter group is negligible. Although generally in the last 15 years, Polish economy dealt with an ageing problem, it is much more evident in the case of the public sector (see Figure 2).

Perhaps the most important area of the change in the structure of employment in the public and private sectors is the qualifications, and in particular, the level of education and occupations. Currently (LFS, 2010), almost half of the public sector employees have higher education, and more than a quarter – vocational secondary education or post-secondary education (see Table 1). In the private sector still the largest employed group are workers with vocational education. Analysis of changes in the past 15 years shows that both sectors have experienced a significant improvement of skills: the share of people with higher education has increased almost three times (or more in the private sector), where in 1995 only 7.5% of employees had higher education (currently 21.7%). The analysis of the educational structure of employment shows that the public sector remains the main source of demand for higher qualifications. Currently 53.6% of all employees with higher education work in the public sector. It should be noted, however, that 15 years ago analogous share was 79.5%, which means that the public sector almost fully absorbed the supply of the highest qualifications in the labour market, which is no longer true.

Table 1. Structure of employment by education levels in the public and private sectors, 1995 and 2010

Education level	1995		2010	
	Public sector	Private sector	Public sector	Private sector
Tertiary	16.94	7.48	48.18	21.66
Post secondary and secondary vocational	33.58	26.81	26.69	28.71
General secondary	7.32	6.96	7.09	10.45
Basic vocational	29.35	43.24	14.96	32.1
Primary and lower	12.81	15.51	3.08	7.07
Total	100.00	100.00	100.00	100.00

Source: Own calculations, LFS data.

Change in the structure of economic activity in the public sector and an increase in the average level of education of its employees led to a significant change in the occupational structure of the population of workers in the sector (see Table 2). In 1995, the largest group of public sector employees were craft and related trades' workers (21%) who, together with a group of technicians and associate professionals accounted for almost 40% of all workers in the sector. By 2010, the share of craft

workers and plant and machine operators significantly decreased, seeing expansion of the share of professionals. It is now the largest group of public sector workers. During the past 15 years this group experienced a two-fold increase of their share in employment also in the private sector, even though it still accounts for only 10.5%, which is more than three times lower than in the public sector, where it is 37.4%.

Table 2. Structure of employment by occupation in public and private sectors, 1995 and 2010

Large Groups of Occupations	1995		2010	
	Public sector	Private sector	Public sector	Private sector
1. Managers	4.81	4.83	4.94	5.58
2. Professionals	17.25	5.14	37.44	10.48
3. Technicians and associated professionals	18.49	9.67	17.81	11.2
4. Clerical support workers	10.61	8.03	10.21	8.43
5. Service and sales workers	5.29	15.9	5.13	16.42
6. Skilled agricultural, forestry and fishery workers	0.77	1.47	0.22	0.59
7. Craft and related trades workers	20.99	32.94	7.03	22.93
8. Plant and machine operators and assemblers	10.19	10.41	5.63	14.9
9. Elementary occupations	11.6	11.61	9.46	9.46
Total	100.0	100.0	100.0	100.0

Source: Own calculations, LFS data.

4. Wages in the public and private sectors in Poland

4.1. Data

The following analysis uses data on wages collected in the LFS by the Central Statistical Office. This survey is conducted quarterly in Poland since May 1992. The population covered by the survey is observed through households. A household is a group of people living together in a dwelling and maintaining themselves jointly. If one of the persons living together maintains him/herself independently then this person creates a separate one-person household. The labour force survey is a probability sample survey. This allows for generalization of the results for the whole population. Since the 4th quarter of 1999 the LFS has been carried out as a continuous survey. This means that in each of 13 weeks in a quarter interviewers visit a determined number (currently it is 4208) of randomly sampled dwellings and collect data concerning economic activity during a preceding week. The survey covers all people at the age 15 years and more, living

in the sampled dwellings. A sample of dwellings to be visited is changed every week. Weekly samples result from a random distribution of a quarterly sample into 13 parts. It was constructed in such a way that each one of 13 weekly samples is not only the same size but has also the same structure. The survey results are compiled and published quarterly. Simplifying somehow, it can be said that the quarterly results are calculated as the mean values of the results from 13 weeks of a given quarter.

Selection of quarterly samples is performed according to the rotation system, which has not been changed since the second quarter of 1993. The rotation system applied in the LFS can be summarized as follows: the sample for each quarter consists of four elementary samples (e-samples for short), according to the continuous survey method they are divided into 13 weekly e-samples; partial rotation of e-samples is carried out every quarter: in a given quarter there are two e-samples surveyed in the previous quarter, one e-sample introduced into the survey for the first time and one e-sample which was not surveyed in the previous quarter and was introduced into the survey exactly a year before; each e-sample is selected independently; results of other e-samples selections are not taken under consideration. As a result of this rotation system each sample is employed according to the 2-(2)-2 rule: two quarters in the survey, two quarters break, again two quarters in the survey and then out[4].

The LFS collects standard data on socio-economic situation of the population, human capital, employment, unemployment, job search, trainings etc. The most important information from the point of view of our analysis are the questions on wages. The respondents are asked to declare their monthly net earnings from the main job in the last 4 weeks preceding the survey. For the purpose of comparability, we have decided to calculate hourly net wages using the average number of hours worked in the past week before the survey was conducted. An important problem with the data on wages in LFS are missing values. In 1995 the share of missing values accounted for only 17.4% but in 2007 it rose to 35%. Beginning with 2008 additional question was added to the survey to indicate the interval of wages if one refuses to provide or does not remember the exact value. In 2010 the problem of missing values accounted for 22.4% of respective population. The problem of missing values can be even more important if one suspects non-random selection of refusals. Luckily, it does not appear to be differentiated by the ownership of employer as 34.14% refuse to give exact wage in the public sector, while 34.17% refuse to provide it in the private one.

Missing data on wages could be imputed using various methods, however, as is discussed in the literature, imputation methods often result in biased parameter estimates, unless the data are Missing Completely at Random (Donders et al,

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[4] Labour Force Survey In Poland I Quarter 2012, CSO, 2012, pp. 23-24.

2006). As Wroniewicz and Strawiński (2013) point out all methods of missing data imputation rely on the assumption that both non-missing and missing values are generated by the same process. This assumption though cannot be tested. If it is not satisfied, the results are biased and serious caution is advised when interpreting all results based on imputation techniques. Therefore we use the information we have in the dataset for complete cases.

The following analysis of the evolution of wages in the public and private sectors covers the period 1995-2010 (yearly data), while the econometric analysis of the wage premium relies solely on the newest data available to the authors, i.e. 2010 (second quarter of 2010 was chosen as the most representative for the whole year as is recommended by Eurostat).

4.2. Evolution and the structure of wages

The figure below, showing the calculated values of net nominal hourly wages of employees (excluding agriculture) in the private and public sectors in the years 1995-2010, reveals that in the analysed years, the average hourly wage was higher in the public sector.
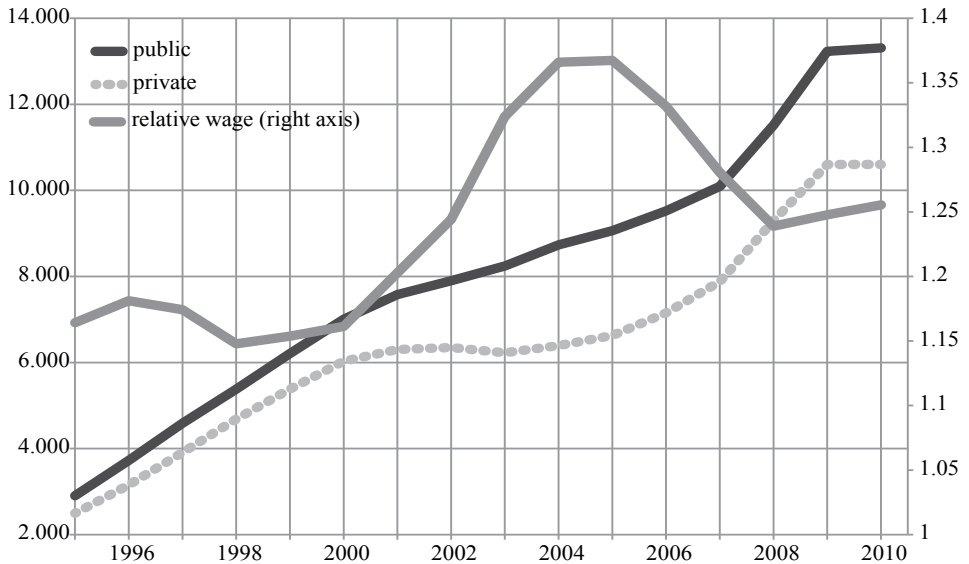
Figure 3. Nominal hourly net wage in the public and private sector, 1995-2010
Source: Own calculations, LFS data.

What's more important, the same figure shows that the public sector relative wage increases continuously over time. Particularly dynamic growth of this relation is observed in the period 2000-2004. It results not so much from a particularly rapid growth of wages in the public sector, but above all, from the slowdown in

the wage growth in the private sector. 2003-2004 was a period of historically the highest unemployment rates in Poland (more than 20%, both in terms of registered unemployment and the LFS unemployment rate). Such high unemployment rates hampered the growth of wages mainly in the private sector, although the public sector also experienced a slight slowdown in this respect. The economic upturn since 2005 contributed to the acceleration in wage growth rates in the private sector, contributing to a reduction in the relative wage from 1.37 to just below 1.24 in 2008.

Table 3 presents a comparison of average net hourly wages by selected characteristics of employment. In most of them, the relative wage of the public sector has increased. There are however interesting exceptions to this rule. Compared to 1995, the relative wage in 2010 declined for the youngest workers, for those with secondary education or less and for occupations not requiring the highest qualifications. With the exception of the youngest and professions of the first two major groups of occupations, the raw average net hourly wages in 2010 are higher in the public sector for all groups.

Table 3. Average net nominal hourly wages by employment characteristics in the public and private sectors, 1995 and 2010

	1995			2010		
	Public	**Private**	**Public/ Private ratio**	**Public**	**Private**	**Public/ Private ratio**
Total	2.89	2.47	116.7	13.30	10.54	126.2
Men	3.08	2.64	116.7	14.31	11.09	129.1
Women	2.67	2.25	119.0	12.58	9.71	129.5
Age under 25	2.24	2.01	111.4	7.93	7.96	99.7
Age 25-44	2.86	2.52	113.8	13.45	10.96	122.7
Age 45-59/64	3.06	2.74	111.6	13.32	10.48	127.1
Age over 59/64	3.41	2.91	117.1	18.49	14.09	131.3
EDU: Tertiary	4.33	4.56	94.9	16.49	15.45	106.8
EDU: post sec. and sec. voc.	2.84	2.63	107.8	11.58	10.12	114.3
EDU: general sec.	2.74	2.48	110.5	10.57	9.71	108.8
EDU: basic vocational	2.55	2.21	115.2	9.61	8.78	109.5
EDU: Primary and lower	2.17	2.01	108.0	7.80	7.65	102.0
Occup. groups 1 and 2	4.08	4.18	97.7	16.89	16.98	99.5
Occup. groups 3-5	2.63	2.33	113.0	11.21	9.70	115.5
Occup. groups 6-9	2.54	2.27	112.0	9.84	9.13	107.7
N	46912	27528	–	41610	77881	–

Source: Own calculations, LFS data.

Wage differentiation can be illustrated using the distribution of the logarithms of nominal hourly wages (Figure 4). We see that the density function of wages for the public sector is clearly shifted to the right in relation to the distribution of wages for the private sector. The coefficient of variation indicates slightly higher concentration of wages in the public sector (CV = 0.61) than private one (CV = 0.64).

On the basis of these observations, the question arises whether the wages offered by the public sector are higher than those in the private one for employees with the same characteristics. Because of important differences in employment structures between the sectors an affirmative answer to the above question may be wrong. It is justified to expect that the level of education, sex, job tenure, size of firm, and other characteristics explain significant amount of wage differentiation observed in the raw data. Next section presents the results of econometric analysis of public sector wage premium in Poland.
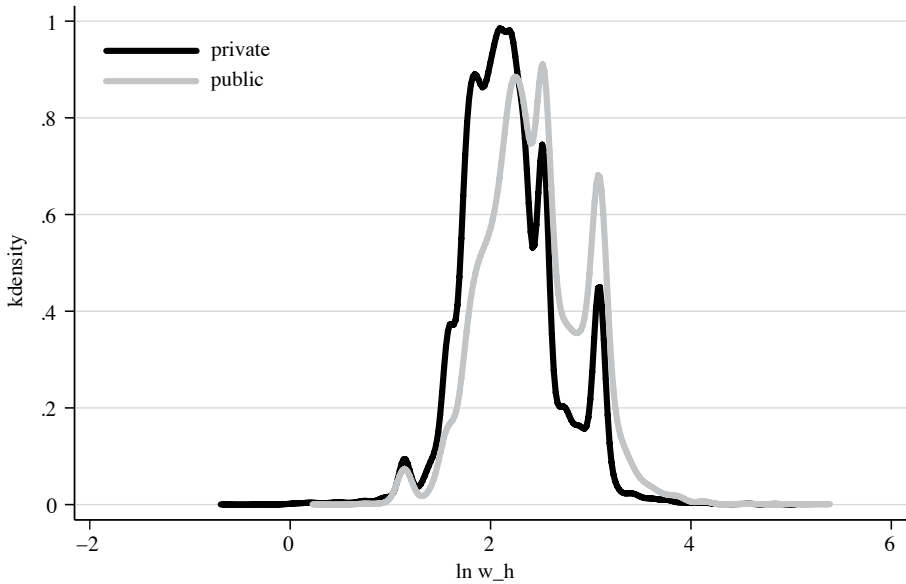
Figure 4. Log of hourly net nominal wage distributions in the private and public sector, 2nd quarter of 2010.
Source: Own calculations, LFS data.

5. Differences in wages as a result of differentiated structures of employment

Table 4 presents basic information on the variables used for the econometric study. Definitions of variables are provided together with descriptive statistics.

Table 4. Definitions of variables used in econometric models

Variable	Definition	Total	Private	Public
Wage	Net hourly wage [PLN]	11.09 (7.01)	10.07 (6.19)	12.95 (7.95)
Sex	1 – man*	0.527	0.600	0.396
	2 – woman	0.473	0.400	0.604
Age	Age [years]	40.4 (11.5)	38.7 (11.7)	43.4 (10.6)
Age2	Age squared	1766.7 (958.8)	1637.9 (956.7)	1999.1 (918.1)
Tenure	Current job tenure [months]	110.8 (115.6)	84.5 (99.8)	158.2 (126.6)
Tenure2	Current job tenure squared	25635.0 (44946.6)	17105.6 (37765.8)	41043.1 (52197.1)
Education (EDU)	1 – tertiary	0.269	0.173	0.441
	2 – secondary vocational and post sec.	0.290	0.294	0.281
	3 – general secondary	0.089	0.099	0.071
	4 – basic vocational	0.289	0.355	0.170
	5 – primary and lower*	0.064	0.078	0.037
Class of settlement unit (CSU)	0 – rural areas*	0.364	0.384	0.327
	1 – towns up to 20 th.	0.153	0.148	0.161
	2 – towns 20-100 th.	0.208	0.200	0.222
	3 – towns over 100 th.	0.276	0.269	0.290
Occupation group (OG)	1 – OG 1, 2 (managers, professionals)	0.233	0.134	0.415
	2 – OG 3, 4, 5 (clerical, office, sales)	0.346	0.354	0.332
	3 – OG 6, 7, 8, 9* (farmers, manual)	0.421	0.512	0.253
Firm size (FS)	1 – up to 10*	0.169	0.235	0.049
	2 – 11 to 49	0.378	0.380	0.374
	3 – 50 to 100	0.149	0.124	0.196
	4 – more than 100 employees	0.304	0.262	0.382
Marital status (MS)	1 – single*	0.238	0.277	0.168
	2 – married	0.688	0.658	0.743
	3 – widowed	0.025	0.022	0.032
	4 – divorced	0.049	0.044	0.057
N	Number of observations	23516	15131	8385

Note: Descriptive statistics for continuous variables show the means and standard deviations in parentheses. For discrete variables shares of given categories are presented. Asterisks denote the reference categories. In the study the sections of economic activity (Polish PKD 2007 two-digit classification) are also used and an ownership sector decoded as 1 for public and 0 for private, which is the reference category.

To cope with the problem of the structural heterogeneity of the population employed in the public and private sectors we will use two methods. We begin with a traditional Mincerean wage equation with a Heckman correction (1979). As this method is based on averages, which may mask important effects of wage differentiation occurring at different points in their distribution, we apply the second method: the quantile regression to examine whether cross-section differences in wages are uniform across the wage distribution. Analysis of the results present in the literature suggests that one should expect rather heterogeneity of the premium along the wage distribution. We state a hypothesis that the wage premium for the public sector, if exists at all, is concentrated in the lower deciles of the wage distribution and is higher for less educated.

5.1. Wage regression with Heckman correction

Dependent variable for the model is the log of net hourly wage ($\ln w_j$). The econometric model can be formulated in the following way (Heckman, 1979):

$$\ln w_j = x_j \beta + u_{1j}$$

$$y_0 = z_j \gamma + u_{2j}$$

$$u_1 \sim N(0, \sigma)$$

$$u_2 \sim N(0, 1)$$

$$corr(u_1, u_2) = \rho$$

where y_0 is a variable with value 1 when a wage for j-th person is observed, γ is a vector of estimated parameters in the selection equation. It contains sex, age, class of settlement unit, marital status and education level. The wage equation contains sex, age, age squared, current job tenure (level and squared), level of education, dummy for public sector, class of settlement unit, section of economic activity, firm size and dummies for groups of occupations. Selection equation includes one variable (marital status) which is not present in the wage equation as is required for model identification.

Table 5 presents the estimates of the above model for the general population ("Total") and for selected subpopulations.

The above estimates show that after controlling for individual characteristics of employment there is a significant and negative public sector wage premium in Poland. Its value for the total population is -4.7%. Estimates for the other parameters are consistent with theoretical predictions, do not raise any controversy and are not the subject of our interest in this paper. The size of the wage penalty for men is only 2.2%, while for women it is 7.3%. Employees with tertiary education exhibit the highest average wage penalty amounting to 10.1%. Similar result,

although of a lesser magnitude, is obtained for the youngest workers, where the penalty is 7.7%. Results of this analysis show that observed positive difference in wages in favour of the public sector actually reverses when the structural differences of employment are controlled for. Next step is to check whether our results are homogenous across the wage distribution.

Table 5. Estimates of the Mincerean wage regression with Heckman correction

	Variable	(1) Total	(2) Men	(3) Women	(4) EDU: Tertiary	(5) Young (under 30)
Wage equation	Women	–0.1611**			–0.1354**	–0.1258**
		[0.000]			[0.000]	[0.002]
	Age	0.0244**	0.0259**	0.0216**	0.0367**	0.2161**
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
	Age2	–0.0002**	–0.0002**	–0.0002**	–0.0003**	–0.0039**
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
	Tenure	0.0012**	0.0011**	0.0012**	0.0012**	0.0057**
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
	Tenure2	–0.0000**	–0.0000**	–0.0000**	–0.0000**	–0.0000**
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
	EDU 1	0.2239**	0.2055**	0.2301**		0.1446
		[0.000]	[0.000]	[0.000]		[0.388]
	EDU 2	0.0610**	0.0798**	0.0260		0.0968
		[0.000]	[0.000]	[0.378]		[0.535]
	EDU 3	0.1070**	0.1506**	0.0558*		0.1765
		[0.000]	[0.000]	[0.027]		[0.095]
	EDU 4	–0.0519**	–0.0480*	–0.0676**		0.0762
		[0.001]	[0.015]	[0.009]		[0.618]
	CSU 1	–0.0011	–0.0065	0.0035	–0.0235	–0.0035
		[0.886]	[0.553]	[0.756]	[0.241]	[0.886]
	CSU 2	0.0070	0.0251*	–0.0134	–0.0454*	0.0179
		[0.333]	[0.014]	[0.188]	[0.011]	[0.396]
	CSU 3	0.0896**	0.1037**	0.0728**	0.0692**	0.1097**
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
	OG 1	0.3643**	0.3281**	0.4520**	0.4160**	0.3569**
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
	OG 2	0.0773**	0.0613**	0.1483**	0.1450**	0.0473**
		[0.000]	[0.000]	[0.000]	[0.000]	[0.007]
	FS 2	0.0949**	0.0973**	0.0927**	0.1521**	0.0766**
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
	FS 3	0.1233**	0.1342**	0.1148**	0.1646**	0.1270**
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
	FS 4	0.1812**	0.2070**	0.1614**	0.2162**	0.1905**
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

	Public sector	–0.0471**	–0.0229	–0.0727**	–0.1010**	–0.0768**
		[0.000]	[0.061]	[0.000]	[0.000]	[0.001]
	Constant	1.4635**	1.4590**	1.3202**	1.2559**	–1.2026
		[0.000]	[0.000]	[0.000]	[0.000]	[0.278]
Selection equation	Women	–0.1883**			0.0643**	–0.2435**
		[0.000]			[0.005]	[0.000]
	Age	–0.0246**	–0.0285**	–0.0209**	–0.0236**	0.1048**
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
	EDU 1	1.2705**	1.0550**	1.4626**		0.9549**
		[0.000]	[0.000]	[0.000]		[0.000]
	EDU 2	0.9993**	0.9000**	1.1167**		0.8790**
		[0.000]	[0.000]	[0.000]		[0.000]
	EDU 3	0.6446**	0.5586**	0.7402**		0.5665**
		[0.000]	[0.000]	[0.000]		[0.000]
	EDU 4	0.9002**	0.8976**	0.8856**		0.8551**
		[0.000]	[0.000]	[0.000]		[0.000]
	MS 2	0.5989**	0.7497**	0.4619**	0.2962**	–0.0079
		[0.000]	[0.000]	[0.000]	[0.000]	[0.778]
	MS 3	0.2918**	0.3365**	0.1712**	–0.1198	0.1293
		[0.000]	[0.000]	[0.000]	[0.125]	[0.707]
	MS 4	0.7104**	0.5751**	0.7288**	0.3741**	0.2677*
		[0.000]	[0.000]	[0.000]	[0.000]	[0.032]
	CSU 1	0.1448**	0.1323**	0.1574**	0.0892*	0.1093**
		[0.000]	[0.000]	[0.000]	[0.020]	[0.001]
	CSU 2	0.1277**	0.1077**	0.1464**	0.1217**	0.0923**
		[0.000]	[0.000]	[0.000]	[0.000]	[0.002]
	CSU 3	0.0810**	0.0750**	0.0870**	0.0289	–0.0014
		[0.000]	[0.000]	[0.000]	[0.314]	[0.959]
	Constant	–0.7178**	–0.5720**	–1.0642**	0.6205**	–3.6752**
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
	Mills lambda	–0.1882**	–0.2209**	–0.1346**	–0.3325**	–0.0830
		[0.000]	[0.000]	[0.000]	[0.000]	[0.720]
	Observations	88.801	42.091	46.710	13.411	22.053
	N_ uncensored	23798	12585	11213	6294	5135

Note: *p-values* are reported in square brackets. Significance is denoted by ** $p<0,01$, * $p<0,05$.

5.2. Quantile wage regression

The econometric model used in previous subsection relied on averages. Quantile regression approach allows us to extend the analysis for the whole distribution of wages.

Let ln w_j be the log of hourly wage, while X_j the vector of regressors capturing individual characteristics of employees as well as the job characteristics. Quantile regression model estimates the θ -th quantile of the distribution of ln w_j conditional on X_j as a linear function of the regressors:

$$Q_\theta \left(\ln w_j \,|\, X_j \right) = X_j \beta_\theta, \quad \text{where} \ \theta \in (0,1).$$

The regressors used in X_j are: sex, age, age squared, current job tenure (level and squared), level of education, dummy for public sector, class of settlement unit, section of economic activity, firm size and dummies for groups of occupations.

The main focus of our analysis is put on the parameter for public sector dummy. Detailed estimates for full model are available from authors on request and for the sake of brevity are not included in this paper. Table 6 shows only the estimates for public sector dummy for each decile of the wage distribution by selected populations.

Results obtained for the general population show a negative public sector wage premium in the magnitude of 5% up to the 7-th decile of the wage distribution. Above the 7-th decile we observe the premium to decline below −10% and for the 95-th percentile it approaches −15%. It indicates that for potentially high wage earners, the wage penalty in the public sector starts to be a real problem. Figure 5 below presents the estimated public sector wage premia with a 95% confidence intervals for selected subpopulations.

Table 6. Estimates of public sector wage premium in the quantile regression model

θ	Total	Men	Women	EDU: Tertiary	EDU: basic voc. and lower	Age under 30
0.1	−0.012	0.015	−0.033	−0.030	0.028	−0.064
	[0.487]	[0.346]	[0.066]	[0.288]	[0.252]	[0.063]
0.2	−0.016	−0.003	−0.035	−0.085	0.027	−0.053
	[0.161]	[0.863]	[0.001]	[0.000]	[0.151]	[0.150]
0.3	−0.019	−0.015	−0.023	−0.087	0.017	−0.050
	[0.101]	[0.433]	[0.008]	[0.005]	[0.352]	[0.039]
0.4	−0.021	−0.018	−0.030	−0.077	0.022	−0.037
	[0.060]	[0.122]	[0.001]	[0.010]	[0.118]	[0.064]
0.5	−0.031	−0.022	−0.051	−0.090	0.009	−0.050
	[0.006]	[0.037]	[0.000]	[0.003]	[0.499]	[0.078]
0.6	−0.042	−0.027	−0.057	−0.103	−0.009	−0.053
	[0.000]	[0.010]	[0.000]	[0.000]	[0.585]	[0.056]
0.7	−0.055	−0.031	−0.071	−0.114	−0.022	−0.071
	[0.000]	[0.034]	[0.000]	[0.000]	[0.288]	[0.001]
0.8	−0.072	−0.035	−0.079	−0.133	−0.042	−0.094
	[0.000]	[0.068]	[0.000]	[0.000]	[0.100]	[0.000]
0.9	−0.105	−0.068	−0.155	−0.133	−0.094	−0.164
	[0.000]	[0.045]	[0.000]	[0.000]	[0.002]	[0.000]
N	23283	12203	11080	6245	8259	5062

Note: p-values are reported in square brackets.

The shape of the public sector wage premium curve looks similarly for men and women, but for men it can be seen a slightly positive wage premium in the left tail of wage distribution. It is not the case for women, who experience negative public wage premia throughout the whole distribution. Particularly high wage penalties in the right tails of distributions are exhibited by persons with tertiary education and younger ones (below the age of 30). Less skilled ones experience slightly lower penalties than the general population.
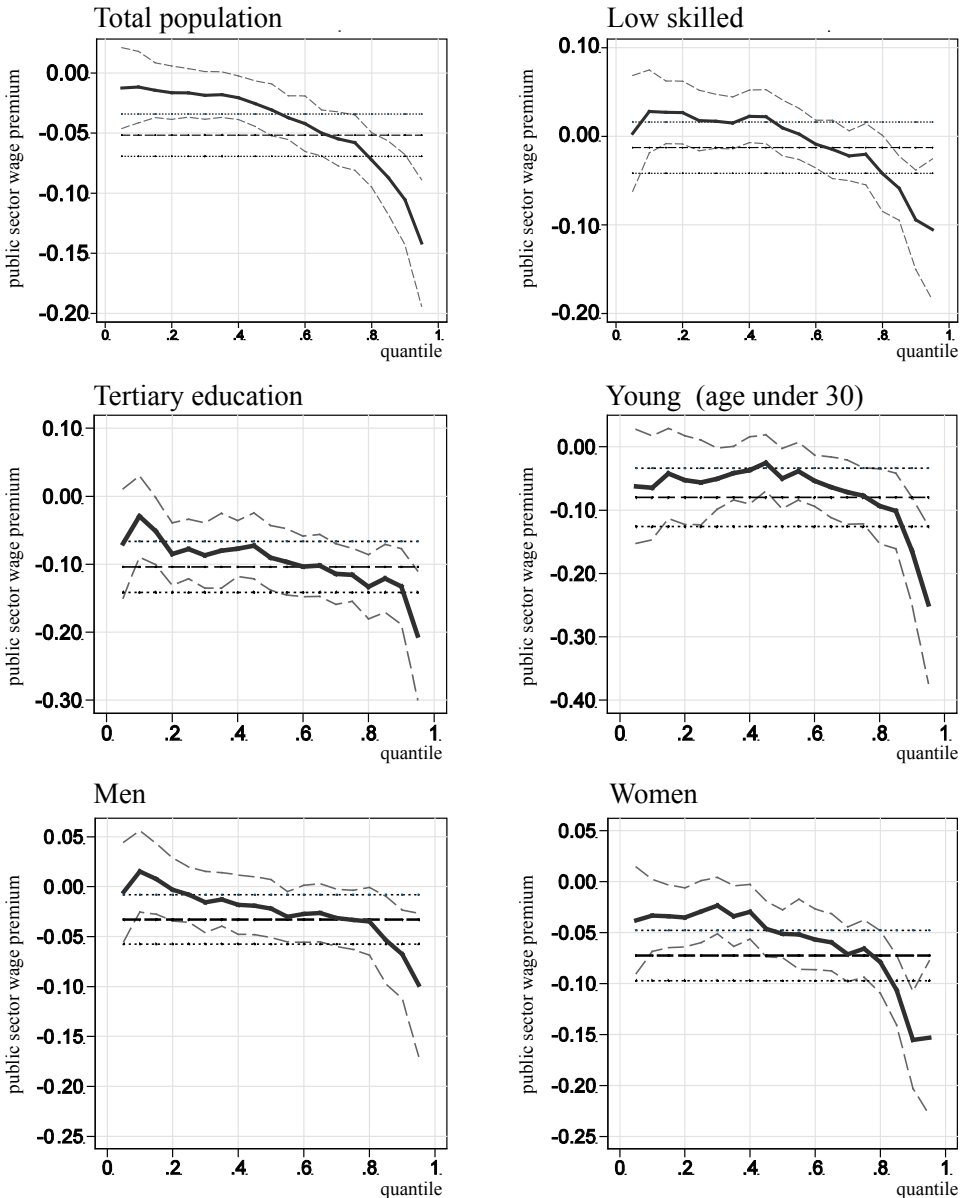
Figure 5. Public sector wage premium for selected populations

Conclusions

The purpose of this article was to estimate the size of the public sector wage premium in Poland 20 years after the beginning of the transformation. This task was carried out using two methods, that is OLS regression with the Heckman correction and quantile regression. Analysis of the results leads to the conclusion that in Poland we observe a negative public sector wage premium. Although the average raw wage in this sector is significantly higher than in the private sector, it results mainly from the concentration of employment with the characteristics which are better rewarded in labour market (e. g. higher qualifications, higher experience, larger firms). The study shows that after controlling for structural characteristics, private sector pays more for otherwise identical employees.

Obtained result is clearly different from the findings of the studies for developed economies, although is quite typical of countries which have undergone transformation. The public sector wage penalty is particularly strong for women, young people and those with higher levels of education. The size of the penalty is clearly differentiated along the wage distribution: for a large part of the distribution it is not significantly different from zero. The observed effect stems from differences on the right tail of the distribution (for those receiving the highest levels of earnings). This pattern is confirmed for all selected subgroups in our study. Further analysis should however include Quantile Selection Models to check weather non-random selection affects quantile effects for wage premium.

Our results lead to several interesting questions. One of them is related to the non-wage benefits of employment, particularly in the public sector. One might expect some compensating benefits of employment in the public sector for those particularly affected by strong wage penalties. These can come in a form of higher job security, stability of employment, prestige, career perspectives and personal development, flexibility of working hours among many others.

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